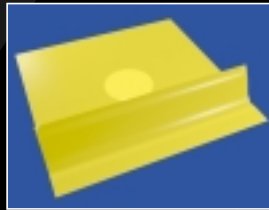


Models of Head Scattered Acoustic Fields for Virtual Acoustic Reality

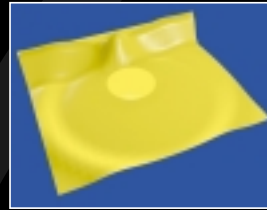
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Computational Engineering & Design Centre

A simplification of a dummy-head model in the form of a sphere is used to simulate in the time domain the scattered sound field around the sphere due to a plane wave



The sound field before the wave impinges the sphere



The sound field after the wave impinges the sphere

The cross-talk cancellation network is simulated by reconciliation of the sphere model and the signal processing theory. In the following example the input signals to the loudspeakers are digitally filtered to produce "1" at the left ear, and "0" at the right ear. When the loudspeakers are placed close together, the production of virtual images is superior to that produced by a conventional loudspeaker arrangement.



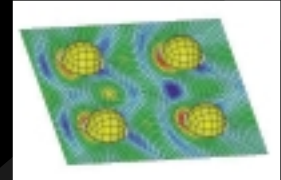
Loudspeaker arrangement: conventional Stereo (+/- 30 deg.)



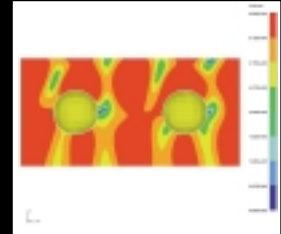
Loudspeaker arrangement: Stereo-Dipole (+/- 5 deg.)

The production of virtual acoustic sources through loudspeakers can be achieved either by the reproduction of dummy-head recordings, or by synthesis of a single source's signals with a set of HRTFs (Head Related Transfer Functions). The principle can be accomplished by ensuring that the acoustic signals produced in the listeners ears are equivalent to the signals that would be produced by a virtual source at a specific angular location.

A more difficult task is to reproduce these desired signals for multiple listeners simultaneously. Consequently, the complexity of numerical calculations demands a high computational cost.



The sound field around four listeners (spheres) at 1000 KHz due to a plane wave source.



The magnitude of the sound pressure (in dB) when the cross-talk cancellation is implemented for two listeners (spheres)

A detailed sound field can be calculated in the frequency and time domains with a BEM method using an accurate mesh of a dummy-head. As frequency increases an accurate model of the pinnae is also required.



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